Hepatitis C transmission and HIV post-exposure prophylaxis after needle- and syringe-sharing in Australian prisons

Belinda G O'Sullivan, Michael H Levy, Kate A Dolan, Jeffrey J Post, Sharon G Barton, Dominic E Dwyer, John M Kaldor and Andrew E Grulich

ABSTRACT

Objectives: To determine whether infection with human immunodeficiency virus (HIV), hepatitis B virus (HBV) or hepatitis C virus (HCV) occurred after two potential episodes of exposure through needle- and syringe-sharing in Australian prisons, and to examine use of post-exposure prophylaxis (PEP) against HIV infection in the prison setting.

Design: Cohort study of potential contacts of two prisoners infected with HIV, HBV and HCV followed up for up to 14 months.

Setting: Two Australian prisons between November 2000 (time of exposure) and December 2001.

Participants: Two index patients (both infected with HIV and HCV; one also infectious for HBV) from two different prisons, and 104 inmates who shared needles and syringes.

Main outcome measures: Seroconversions to HIV, HBV and HCV related to the high-risk exposure and uptake and completion of HIV PEP determined from medical records of inmates.

Results: There were four seroconversions to HCV within 14 months of the potential exposure (14% of those susceptible in the cohort), but no recorded HIV or HBV seroconversions. Forty-six inmates (82% of those eligible) were offered PEP, and 34 of these (74%) elected to receive it. Only eight (24% of the 34) completed the full PEP course.

Conclusions: HCV transmission in the prison setting is related to high-risk needle- and syringe-sharing. Administering HIV PEP in the prison setting is complicated by challenging risk assessment and follow-up.

MJA 2003; 178: 546–549

New South Wales Department of Health, Sydney, NSW.

Belinda G O'Sullivan, MPH, GradDipAppEpi, Epidemiologist, New South Wales Health Survey Program.

New South Wales Corrections Health Service, Sydney, NSW.

Michael H Levy, MB MS, MPH, Director, Population Health;
Sharon G Barton, DipApplSc, Clinical Nurse Consultant.

University of New South Wales, Sydney, NSW.

Kate A Dolan, PhD, Senior Lecturer, National Drug and Alcohol Research Centre;
John M Kaldor, PhD, Professor, National Centre in HIV Epidemiology and Clinical Research;
Andrew E Grulich, PhD, Associate Professor, National Centre in HIV Epidemiology and Clinical Research.

Albion Street Centre and Department of Infectious Diseases, Prince of Wales Hospital, Sydney, NSW.

Jeffrey J Post, FRACP, Infectious Diseases Physician.

Institute of Clinical Pathology and Medical Research, Westmead Hospital, Sydney, NSW.

Dominic E Dwyer, MD, FRACP, FRCPA, Medical Virologist.

Reprints will not be available from the authors. Correspondence: Dr Andrew E Grulich, National Centre in HIV Epidemiology and Clinical Research, University of New South Wales, 376 Victoria Street, Darlinghurst, Sydney, NSW 2010. agrulich@nchecr.unsw.edu.au

TRANSMISSION OF HUMAN immunodeficiency virus (HIV),[1,2] hepatitis B virus (HBV)[2] and hepatitis C virus (HCV)[3,4] has been documented in correctional settings. Transmission is related to the increased prevalence of these agents in the prison population, high-risk injecting and sexual behaviour, and the limited availability of prevention methods.[5,6] Post-exposure prophylaxis (PEP) against HIV has been recommended in New South Wales for non-occupational exposures to HIV since 1998.[7]

The aim of our study was to determine if transmission of HIV, HBV and HCV occurred after episodes of needle-sharing with two inmates with HIV infection in Australian prisons in November 2000, and to evaluate the use of HIV PEP in this setting.

METHODS

The study was approved by the Corrections Health Service Human Research Ethics Committee.

Index patients

In prison A, the index patient (Index patient A) disclosed to nursing staff in November 2000 that he was infected with HIV and had shared two needles and syringes in the previous 5 days, while incarcerated. The inmate did not identify his sharing partners and shared again the following day.

In prison B, the index patient (Index patient B) was found to be HIV seropositive after presenting for voluntary testing in November 2000. He disclosed sharing a needle and syringe with other inmates in the previous three weeks while incarcerated and identified several sharing partners in the prison.

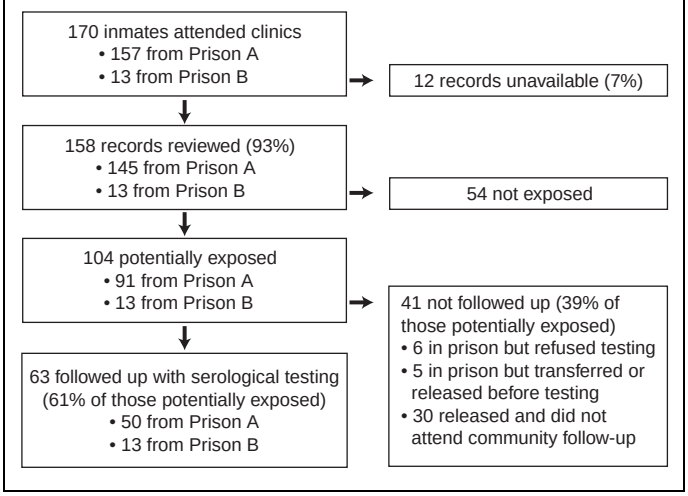
Potentially exposed inmates

Inmates in the two prisons were contacted through peer outreach and con-

tact tracing, and were invited to attend the prison clinic if they had shared needles or syringes between 5 and 29 November 2000 (the risk period). All inmates who reported sharing injecting equipment during this period were considered potentially exposed to HIV, HBV and HCV infection, although it was usually not known if they had shared with an index patient.

Attending inmates were assessed for risk behaviour, presence of HIV, HBV and HCV antibodies, HBV vaccination status, and need for HBV immunoglobulin and HIV PEP, before referral for methadone assessment. Specialist medical staff assessed inmates for PEP. Those who were HBV antibody-negative were eligible for HBV vaccination and immunoglobulin, and those who were HIV-negative were eligible for PEP. Clinic staff routinely recorded these data in a structured medical record.

1: Participants at each stage of the study



Baseline assessment

The following baseline data were systematically collected from inmates' medical records by a single researcher (BGO'S): injecting drug history; needle and syringe sharing in the risk period; other risk behaviours; HIV, HBV and HCV antibody results at the time of initial clinic presentation; and PEP prescription.

Inmates were excluded from the study if there was no documented evidence that they shared injecting equipment in the risk period.

Follow-up assessment

Inmates were followed up for up to 14 months. Serological and risk data were systematically collected from medical records by the same researcher (BGO'S). In addition, data on evidence of clinical HIV, HBV or HCV seroconversion illness, and compliance and side effects of PEP were collected.

Inmates were referred for a single follow-up serological test between March and December 2001 if they were still incarcerated. Those who had been released were sent letters requesting that they seek free follow-up testing at a local clinic, with the offer of $30 for travel costs, and had their records flagged for testing in the event of re-incarceration.

RESULTS

Index patients

Index patient A was positive for anti-HIV antibodies and for HBV infection (positive for HBV surface antigen; HBV DNA level of 33.506 pg/mL; and negative for HBV e antigen and for IgM to HBV core antigen). He was also positive for anti-HCV antibodies, with serum HCV RNA detected in February 2000 but not retested in November 2000. He had been diagnosed with HIV infection in the community in April 1999. In November 2000, he had an HIV viral load of 22 000 RNA copies/mL, and CD4 T-lymphocyte count of 0.09×10^9/L (reference range, $0.38–1.39 \times 10^9$/L) and was not compliant with antiretroviral therapy.

Index patient B was negative for anti-HIV antibodies in early September 2000 while incarcerated. He was released in mid-September and was reported to have shared needles and syringes with an HIV infected person in the community during this period. He was re-incarcerated in mid-October 2000 and had a serological profile suggesting recent HIV-1 infection: HIV plasma load of 64 900 RNA copies/mL, and CD4 T-lymphocyte count of 0.62×10^9/L. This patient was also anti-HBV-positive but not infectious (positive for antibodies to HBV core and surface antigens; not tested for HBV surface antigen [HBs]) and was infected with HCV (anti-HCV-positive; not tested for HCV RNA).

Potentially exposed inmates

One hundred and seventy inmates attended the clinics in response to the invitation. Participants at each stage of the study are shown in Box 1. Medical records of 158 (93%) were reviewed. On the basis of information on sharing in these records, 104 inmates (66% of those reviewed) were assessed as potentially exposed, comprising 91 of the 157 inmates who attended the clinic in prison A (58%) and all 13 inmates who attended in prison B.

Baseline serological results were available for all 104 potentially exposed

2: Baseline serological results of inmates potentially exposed to HIV and hepatitis B and C virus infection

Serological result	Prison A (*n*=91)	Prison B (*n*=13)
HIV		
Negative	91 (100%)	13 (100%)
Hepatitis B virus		
Non-immune*	25 (27%)	4 (31%)
Immune or previously infected†	63 (69%)	9 (69%)
Unknown	3 (3%)	0
Hepatitis C virus		
Negative‡	24 (26%)	5 (38%)
Positive§	67 (74%)	8 (62%)

* Hepatitis B non-immune: negative for antibodies to hepatitis B virus surface and core antigens (anti-HBs and anti-HBc, respectively).
† Hepatitis B immune or previously infected: positive for anti-HBs and/or anti-HBc; 36 of this group (50%) were immune (anti-HBs-positive)
‡ Hepatitis C negative: negative for antibodies to hepatitis C virus (anti-HCV).
§ Hepatitis C positive: anti-HCV-positive; HCV RNA testing was not performed.

3: Characteristics of four inmates who seroconverted to hepatitis C virus (HCV) after sharing needles and syringes in November 2000 in two Australian prisons

Case (prison)	Anti-HCV results	Months to positive*	Period of incarceration	Risk factors		Clinical history after November 2000
				November 2000	Ongoing	
1 (B)	Negative: 11 Dec 00 Positive: 15 Mar 01	3	Mar 00 – Apr 01	First time IDU in Oct 00 in prison Shared needle and syringe without routine cleaning with Seroconverters 2 and 3, and with another anti-HCV-positive inmate (not directly with the index patient)	None	No seroconversion illness
2 (B)	Negative: 12 Dec 00 Positive: 9 May 01	5	Feb 00 – Jun 01	Frequent IDU Shared needle and syringe with Seroconverters 1 and 3 and another anti-HCV-positive inmate (not directly with the index patient)	Ongoing frequent shared IDU Unprotected sex	No seroconversion illness
3 (B)	Negative: 12 Dec 00, 30 Mar 01 Positive: 29 Aug 01	5	Nov 00 – ongoing (May 02)	Shared needle and syringe with Seroconverters 1 and 2, and with three other anti-HCV-positive inmates (not directly with the index patient)	Ongoing IDU	Non-specific recurrent illness with rash on hands and feet, malaise, arthralgia (Jul–Sep 01) Mild systemic illness (Oct 01) (anti-HIV-negative in Oct 02)
4 (A)	Negative: 25 Nov 00 Positive: 13 Dec 01	13	Nov 00 – Jun 01, Oct 01 – ongoing (May 02)	IDU	IDU with sharing in prison IDU without sharing in community	No seroconversion illness

IDU = injecting drug use. Anti-HCV = antibodies to hepatitis C virus. * Months between last anti-HCV negative result and first anti-HCV positive result.

inmates (Box 2). Seventy-four were still in prison when their medical records were reviewed, and follow-up serological testing was conducted in 63 (61% of those potentially exposed) (Box 1).

Seroconversions

Of the 63 inmates with follow-up serological results, four had undergone HCV seroconversion (14% of the 29 inmates susceptible to HCV in the cohort), but none had undergone HIV or HBV seroconversion. One of those who seroconverted to HCV was in prison A during the risk period (1% of the 91 inmates potentially exposed), and the other three were in prison B (23% of the 13 potentially exposed).

Characteristics of those who seroconverted are shown in Box 3. Seroconversion occurred within 3–14 months of the potential exposure. The three inmates in prison B who seroconverted to HCV reported sharing needles and syringes with each other, as well as with other HCV-infected inmates during the risk period. All three were continuously incarcerated.

Post-exposure prophylaxis

Of the 104 potentially exposed inmates, 56 (54%) were eligible for HIV PEP (62% of all potentially exposed in prison A; none in prison B) as their exposure had occurred within the 72 hours before they attended the clinic. Of these, 46 were offered PEP (82% of those eligible), and 34 elected to receive it (74%). They were prescribed zidovudine and lamivudine. The main reasons for inmates electing not to take PEP included the belief that they had used a new syringe, had not shared with the index patients, or had cleaned the injecting equipment with bleach. Reasons for not offering PEP were not recorded.

The median period of taking PEP was 18 days, and compliance with therapy was reported as complete for eight inmates (24%), moderate for 22 (65%), and poor (many doses missed) for four (12%). Of the 26 who did not complete the full course, 11 did not give a reason. However, PEP was commonly ceased when inmates were transferred or released. No serious adverse effects were reported.

Among inmates susceptible to HBV at baseline, 24 (83%) received HBV vaccination or immunoglobulin and had protective antibodies (serum anti-HBs levels > 10 μL/mL) at follow-up.

DISCUSSION

Our study demonstrates four HCV seroconversions most likely related to high-risk needle- and syringe-sharing in prison, and outlines the first documented use of HIV PEP in the prison setting anywhere in the world. A minority of those prescribed PEP completed the course.

Only a small proportion of the inmates in either prison were susceptible to HBV or HCV at baseline, but all were susceptible to HIV. Our findings are consistent with the higher probability of transmitting HCV compared with HIV through sharing needles and syringes.[8] Nevertheless, it is possible that HIV seroconversions did occur in inmates who were lost to follow-up. Treatment of HBV-susceptible inmates with HBV vaccination or immunoglobulin after the potentially high-risk expo-

sure may have prevented any HBV seroconversions in those followed up.

It is difficult to be certain that each new HCV infection was related to the documented exposure. Seroconverter 1 was probably infected in prison B in November 2000, as he was a new injecting drug user and reported multiple exposures in the prison. The other HCV-infected patients all reported ongoing injecting drug use in prison and may have acquired their HCV infection after the risk period.

Index patient A did not identify contacts, meaning that all inmates who reported needle or syringe sharing in prison A were screened. This risk assessment process is likely to have overestimated the number of inmates truly exposed in prison A compared with prison B, where the cohort was smaller, and the pattern of sharing needles and syringes was more easily determined.

Inmates were initially provided with a four-week course of PEP, but it became evident that some were trading the PEP for other commodities. As a result, prison health staff started administering daily doses of PEP to inmates at the prison clinic. This method, while avoiding misuse of PEP, may have influenced discontinuation with therapy, given the frequent and unpredictable movement of inmates between prisons, courts and the community.

While guidelines indicate that individuals prescribed PEP should be followed up for six months to confirm serological status,[7] this was difficult to arrange in the prison environment. A quarter of inmates who started PEP completed it. Completion is generally much better in the community.[9]

We have documented hepatitis C transmission in the prison setting, probably related to sharing of injecting equipment. Possible prevention measures that might be implemented include needle and syringe exchange programs, which are the community standard. While HIV PEP may be administered in the prison setting, special consideration of prison circumstances is necessary to ensure accurate risk assessment, consideration of ongoing risk behaviours, prompt initiation of therapy, good compliance and adequate follow-up. Specific guidelines for the use of PEP in prisons should be developed by correctional health services to improve the administration of PEP in the prison setting.

COMPETING INTERESTS

None identified.

ACKNOWLEDGEMENTS

We thank the Department of Corrective Services and Corrections Health Service, particularly the public health nurses who assisted with follow-up of inmates. We also thank Associate Professor Andrew Lloyd, who chaired the collaborative research group, as well as Ms Evelyn Crewe and Dr Jean Downie (Institute of Clinical Pathology and Medical Research, Westmead Hospital, Sydney, NSW) for serological testing.
This study was carried out as part of the New South Wales Public Health Officer Training Program, which is funded by the New South Wales Department of Health. The National Centre in HIV Epidemiology and Clinical Research is funded by the Commonwealth Department of Health and Ageing.

REFERENCES

1. Dolan K, Wodak A. HIV transmission in a prison system in an Australian State. *Med J Aust* 1999; 171: 14-17.
2. Taylor A, Goldberg D, Emslie J, et al. Outbreak of HIV infection in a Scottish prison. *BMJ* 1995; 310: 289-292.
3. Haber P, Parsons S, Haper S, et al. Transmission of hepatitis C within Australian prisons. *Med J Aust* 1999; 171: 31-33.
4. Post JJ, Dolan KA, Whybin LR, et al. Acute hepatitis C virus infection in an Australian prison inmate: tattooing as a possible transmission route. *Med J Aust* 2001; 174: 183-184.
5. Butler TG, Dolan KA, Ferson MJ, et al. Hepatitis B and C in New South Wales prisons: prevalence and risk factors. *Med J Aust* 1997; 166: 127.
6. National Centre in HIV Epidemiology and Clinical Research. HIV/AIDS, viral hepatitis and sexually transmissible infections in Australia annual surveillance report 2001. Sydney: National Centre in HIV Epidemiology and Clinical Research, University of New South Wales, 2001.
7. Management of non-occupational exposure to blood borne and sexually transmissible diseases. New South Wales Health Department Circular 99/31, 31 Mar 1999. (supersedes circular 98/106, 12 Nov 1998).
8. Bodsworth NJ, Robertson M, Kaldor J. Transmission of hepatitis C virus but not human immunodeficiency virus type 1 following sharing of cleaned injecting equipment. *Genitourinary Med* 1994; 70: 206-207.
9. Correll P, Smith D, Grulich A. Post exposure prophylaxis for non-occupational exposure to HIV: experience in New South Wales one year after the guidelines. *NSW Public Health Bull* 2000; 11: 114-117.

(Received 30 Oct 2002, accepted 23 Jan 2003) ❑